A constraint-based approach to the chameleon /r/ in Mandarin dialects

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1. Introduction

In various Mandarin dialects, the retroflex [r] has been closely associated with a series of affixation processes. In the literature, r-suffixation refers to the incorporation of the diminutive morpheme /r/ into a target word. In the majority of Mandarin dialects such as Beijing (Jia 1992), the diminutive morpheme takes the form of a suffixal retroflex /ɾ/ (1):

(1) Beijing[1]

Stem	Diminutive	Gloss
ma	mar	*horse*
pao	paor	*bag*
tou	tour	*pocket*
p'o	p'or	*wife*
k'e	k'er	*song*
bā	bār	*bar*
tɕia	tɕiar	*home*
you	your	*oil*
ye	yer	*leaf*
iə	biər	*nose*
ɕyā	ɕyār	*starlet*

In addition, r-suffixation is often accompanied by other phonological changes to the input. In Anxiang (Ying 1990) and Sichuan (Li 1986), for example, a monosyllabic input has to be bisyllabified so that the diminutive /r/ can be incorporated into the derived second syllable (2):

(2) Anxiang

Stem	Diminutive	Gloss
tyi	tyi.tyər	*flute*
p'a	p'a.p'ər	*claw*

1 Transcriptions in this paper are adopted from the original source. It should be noted that the syllable final [u] and [i] in diphthongs are the glides [w] and [j] respectively. Confusion in this manner has its historical origins. See Duanmu (1990) for more detailed arguments for this interpretation.

ke	ke.kər	*square*
to	to.tər	*pile*
fa	fa.fər	*trick*
p'wu	p'wu.p'wər	*shop*
p'au	p'au.p'ər	*bulb*
tou	tou.tər	*peak*
loŋ	loŋ.lər	*cage*
kan	kan.kər	*stick*
tye	tye.tyər	*plate*
myan	myan.myər	*quilt*
yan	yan.yər	*courtyard*
xwaŋ	xwaŋ.xwər	*frame*

Still in other Mandarin dialects, the diminutive morpheme is found to be an infix rather than the canonical suffix. In Pingding (Xu 1981), for example, the morpheme is realized as a perceptually distinct retroflex lateral /l/ (3). Similar phenomenon is also attested in other dialects such as Yanggu (Dong 1985) and Jinxiang (Ma 1984).

(3) Pingding

Stem	Diminutive	Gloss
ie?.tiæ	ie?.tlɐ	*a little bit*
ɕiɑɔ.kʰʏu.tæɛ	ɕiɑɔ.kʰʏu.tlɒ	*a small pocket*
tʏu	tlʏu	*pocket*
su.tsʰʌ	su.tsʰlʌ	*branch*
xu.lu	xu.llu	*hard squash*
tɒɔ.pa	tɒɔ.plʌ	*knife handle*
pʰæɛ	pʰlɒ	*poker*
xʏu.mʏŋ	xʏu.mlʏŋ	*back door*
tɕi.tæ.xuaŋ	tɕi.tæ.xluaŋ	*egg yolk*
ie?.tiæ	ie?.tlɐ	*a little bit*
ɕiɑɔ.kʰʏu.tæɛ	ɕiɑɔ.kʰʏu.tlɒ	*a small pocket*

Closely related to the r-suffixation process is the so-called l-infixation phenomenon in some Mandarin dialects where a plain lateral is inserted into a monosyllabic stem resulting in a bisyllable. Jianou (Pan 1994) is a case in point (4). Similar dialects include Yikol (Li 1991), Fuzhou (Liang 1982) and Taiyuan (Zhao 1979).

(4) Jianou

Stem	l-infixed words	Gloss
pu	pu.lu	*roll*
niau	niau.liau	*wind*
tiŋ	tiŋ.liŋ	*twist*
ts'u	ts'u.lu	*flip one's eye*
paiŋ	paiŋ.liaŋ	*turn around*
tse	tse.le	*wrinkle*
kau	kau.lau	*mix, blend*
k'y	k'y.ly	*curly*
k'i	k'i.li	*lean aside*

yiŋ	yiŋ.lyiŋ	*lean aside*
ɔŋ	ɔŋ.lɔŋ	*blend*
pa	pa.la	*untidy*
ŋaŋ	ŋaŋ.laŋ	*clog*
mɔ	mɔ.lɔ	*unsmooth*

Hence, we have a full range of affixation processes in Mandarin dialects in which the locus of the diminutive affix varies in each particular dialect resulting in either a suffix or infix. (5) summarizes the above observations:

(5) {CV(C), r}
a. CV(C)r: /r/ as a suffix (Beijing)
b. CV(C).Cər: /r/ as a suffix in a derived syllable (Anxiang)
c. C⌊V(C): /r/ as a lateral retroflex, part of complex onset (Pingding)
d. CV(C).lV(C): /r/ as a plain lateral onset on a derived syllable (Jianou)

The fact that a certain element (such as the diminutive affix in our case) may surface at different positions in the output is, however, not limited to Mandarin Chinese alone. The same pattern of morpho-phonological variations, especially the relevant landing site(s) of a certain element, is also attested in other languages in the world. In the case of affixation, for example, the Tagalog infix *-um-* is reported surfacing as a prefix in certain phonological context (c.f. McCarthy and Prince 1993). Clitics in Romance and southern Slavic languages such as Hungarian and Croatian also demonstrate a similar behavior in that they could either appear at the phrasal initial or secondary (i.e., after the first morpheme) position (Anderson 1995).

In derivational phonology, the various edge-oriented affixation processes are treated with different devices. While both pure prefixation and suffixation can be handled straight forward within the domain of morphology and without much complication, infixation is often argued as prosodically defined and has to be treated with the device of prosodic circumscription (McCarthy and Prince 1986). In the case of Mandarin Chinese, both r-suffixation and l-infixation have been the subject of intensive research in studies such as Lin (1989), Duanmu (1990), Chen (1992), Yip (1992) and Wang (1994), etc. Various accounts are available, ranging from Prosodic, Licensing to Epenthetic Accounts.

The purpose of this paper is to provide a unified account of the two affixation processes in the four representative Mandarin dialects. Based on past insights into the phenomena, we are going to show that the seemingly different r-suffixation and l-infixation can be accounted for in terms of the Generalized Alignment Theory (McCarthy and Prince 1993) within the framework of Optimality Theory (Prince and Smolensky 1993). In particular, we are going to show that the specific location of the diminutive morpheme in each dialect is accountable in terms of the interaction between the constraint ALIGN and other constraints such as the well-formed conditions on syllable structures in Mandarin Chinese.

The rest of the paper is organized as follows: In Section 2, we will briefly review the Optimality Theory in which the notion of Generalized Alignment will be highlighted. In Section 3, we will present our Optimality-theoretic analysis of the two affixation processes in four Mandarin dialects. In Section 4, we will conclude the paper with a brief summary of the major issues to be discussed in this paper.

2. Affixation in Optimality Theory

Optimality Theory (OT, Prince and Smolensky 1993) is a model of constraints and constraint interaction on output representations. In this model, the role of grammar is to select, through the function EVAL, the optimal output from a (possibly infinite) set of candidates generated by the function GEN.

In OT, the function GEN contains a set of optional operations responsible for mapping each input representation into a set of output candidates. An example of the optional operations in GEN is insertion through which segments as well as other features can be added to the input (6):

(6) GEN (optional):
Insertion: $\emptyset \rightarrow X$

The set of output candidates from GEN is then fed into the function EVAL for evaluation. EVAL contains a hierarchy of ranked constraints which rates in parallel the well-formedness of each member of the candidate set, from which the optimal output, the one with least violations of the ordered constraints, can be selected.

An important set of constraints in OT is the set of Faithfulness Constraints (7) which are responsible for input-output correspondences:

(7) Faithfulness Conditions1
(a) PARSE(X):
X must be incorporated into the phonetically-interpreted representation.
(b) *STRUCT(X):
*X, where X is a representational element.

For evaluation, PARSE will register a violation for each unparsed element in the output representation, whereas *STRUCT will assign a star '*' for each parsed element in the output string. For example, in a syllabification process, PARSE will require that every root node of a candidate must be associated with either a syllable or a mora, while *STRUCT forbids such an association. Whatever elements they are associated with, the function of the two competing constraints is to make sure that any modifications on the input (by GEN) must be motivated. When they are undominated by other constraints, every element in the input will be realized in the output. It is only when the set of Faithfulness Constraints either dominates or is dominated by other constraints that output deviation from the input representation may be allowed to occur.

In the case of affixation, the three constituent-edge oriented processes, namely, prefixation, infixation and suffixation, can be subsumed under a single family of well-formedness constraints called Generalized Alignment (GA, 8) (McCarthy and Prince 1993):

(8) Generalized Alignment
Align(Cat 1, Edge1, Cat2, Edge2) $=_{def}$
$\forall$ Cat1 $\exists$ Cat2 such that Edge1 of Cat1 and Edge2 of Cat2 coincide.
Where
Cat1, Cat2 $\in$ PCat $\cup$ GCat
Edge1, Edge2 $\in$ {Right, Left}

1 The set of Faithfulness Constraints adopted in this paper follows Prince and Smolensky (1993). Please refer to McCarthy and Prince (1995) for a revised version of Faithfulness Constraints based on the Correspondence Theory.

In (8) PCat and GCat refer to possible prosodic and grammatical categories, respectively. This constraint requires that a particular edge of Category 1 align along the left- or rightmost edge of Category 2. A case of no violation is, of course, either pure prefixation or suffixation in which no other phonological changes take place. That is, GA is not dominated by any other constraints. However, when other constraints dominate GA, variations will occur. For example, if we have some phonological constraints dominating GA, we will witness some phonologically induced changes during the process of affixation, as in the case of Tagalog affixation.

In Tagalog, according to McCarthy and Prince (1993), it is observed that the affix *-um-* falls as near as possible to the left edge of the stem, so long as it obeys the phonological requirement that its final consonant *m* not be syllabified as a coda (9):

(9) Tagalog affixation (= (2) in McCarthy and Prince 1993)

u.ma.ral	'teach'
su.mu.lat	'write'
gru.mad.wet	'graduate'

It is obvious that the locus of the infix *-um-* is prosodically defined, which is a response to the prosodic condition requiring open syllables in the language. In McCarthy and Prince (1993), the locus of *-um-* can be said to be determined by the interaction of the constraints NO-CODA and ALIGN (10):

(10) Tagalog Constraints (= (42) in McCarthy and Prince 1993)
a. NO-CODA: Syllables are open
b. ALIGN-*um*: Align($[\text{um}]_{AF}$, L, Stem, L)

When these two constraints interact with each other, we have the following evaluation in terms of a crucial ranking NO-CODA >> ALIGN (11= (43) in McCarthy and Prince 1993):

(11) Input: $\{\text{um, gradwet}\}_{\text{Stem}}$
Constraint hierarchy: No-CODA >> ALIGN-*um*

	Candidates	No-CODA	ALIGN-*um*
a.	[-um.grad.wet.	***!	
b.	[g-um.rad.wet.	***!	g
c. ☞	[gru.mad.wet.	**	gr
d.	[grad.w-u.met.	**	gradw!

In the above tableau (from McCarthy and Prince 1993), '[' indicates the left edge of a stem and '-' the left edge of *-um*. Violation of the constraint ALIGN-*um* is accessed in terms of the string of segments separating the left edge of *-um-* from the left edge of the stem. It is apparent that (11c) emerges as the most optimal output since it constitutes the least violation of both the crucial No-CODA and to a less degree, the deciding ALIGN.

3. Affixation in four Mandarin dialects

In this section, we are going to examine both r-suffixation and l-infixation in four Mandarin dialects. We will argue that the affixation paradigm (5) is accountable in terms of the interaction between the constraint ALIGN and other constraints such as the set of conditions on the well-formedness of syllable structure in Mandarin Chinese. In particular, we will show that when ALIGN is undominated in the constraint hierarchy, we will find the r-suffixation patterns as attested in Beijing (Section 3.2) and Anxiang (Section 3.3). In

contrast, when other phonological constraints dominate ALIGN, we will observe the l-infixation patterns as in Pingding (Section 3.4) and Jianou (Section 3.5).

Before we plunge into an examination of the four dialects, it is first necessary for us to take a brief look at the syllable structure and the origin of /r/ affixation in Mandarin Chinese. This brief review is aimed at motivating constraints from other independent evidence which will be used to account for the locus of the diminutive affix in the four dialects concerned.

3.1 Syllable structure and the retroflex /r/ in Mandarin Chinese

3.1.1 Syllable structure

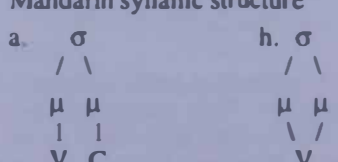
According to sources cited in Feng (1995), Old Chinese has a CCVCC syllable structure. Since then, a syllable simplification process has taken place. Consonants are lost at both the syllable onset and coda positions with the latter at a much faster speed. As a result, modern Mandarin Chinese has a C(G)V(C) syllable in which the onset C can be of any consonants in its inventory except the velar nasal [ŋ] and the G the glides /j/ and /w/ (c.f. Duanmu 1990 and 1993, among others). In contrast, the coda C is limited to nasals, glides and the coronal retroflex [r]. From CCVCC to C(G)V(C), changes in Mandarin syllable structure reveal the existence of phonological preferences which disfavors both complex onsets and codas. In terms of OT, these phonological preferences can be translated into two universal constraints on the well-formedness of syllable structures (12) (Itô 1989):

(12) Well-formed conditions on syllable structure
a. *COMPLEX: No sequences of segments are allowed either at the onset or coda position.
b. *CODA: *C]$_\sigma$ Syllable final coda is prohibited.

In terms of evaluation, *COMPLEX disallows a sequence of more than one segment at either the onset or coda position in a syllable. It will assign a star for any two consonantal segments in a row. (However, note that this constraint is unmarked in many other languages such as English.) Similarly, the constraint *CODA prohibits the presence of segment(s) at the coda position in a syllable. A violation will be registered for every consonantal segment at the coda position.

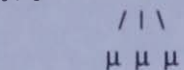
Apart from the simplification of its segmental composition, a syllable in Mandarin is also reduced to have a limited size. Though there are both closed and open syllables in Modern Mandarin, it has been argued that they are uniformly heavy bearing two X-slots (or two moras) (Duanmu 1990 and 1993), whether the rime of a syllable contains either a single vowel or diphthong. Hence, a single vowel in an open syllable is to be interpreted as being associated with two moras. (13) gives the two possible Mandarin syllable types in which the onset is omitted from representation:

(13) Mandarin syllabic structure



Empirical evidence in support of this representation of Mandarin syllable comes from such phonetic studies as Lin and Yan (1988) who report that the average rime duration of all types of syllables in Mandarin is on the order of 200 ms. The only exception to this is the so-called neutralized syllable which contains a neutral vowel [ə]. Its duration is about two-thirds of a full syllable. Hence, phonologically speaking, it can be said that there is an upper limit on the weight of a syllable in Mandarin Chinese which prohibits a super heavy syllable with more than two moras. In terms of OT, this can be translated as the constraint *HEAVY (14):

(14) *HEAVY



In Mandarin dialects, super heavy syllable is avoided.

3.1.2 The retroflex /r/ and the diminutive morpheme

The coronal retroflex [r] in Mandarin Chinese has a limited distribution. It occurs at the onset position with a very limited number of vowels but never co-occurring with glides to form part of a complex onsets. More often it occurs syllable finally with almost all the vowels in its inventory. At this position, the retroflex is used as a diminutive morpheme whose insertion is called r-suffixation. It is has been proposed in the literature that r-suffixation is mainly due to language contact (c.f. Xu 1981 and Li 1994, among others). It took place around the thirteenth century when Mandarin speakers came in contact with speakers of Altaic languages such as Mongolian in which the /r/ suffix is abundant. It became a prominent phenomenon in Mandarin Chinese no later than the early Qing Dynasty. A proper formulation of this distribution can be stated in the following constraint ALIGN (15):

(15) ALIGN($[r]_{AF}$, R, Stem, R)
Align the diminutive morpheme /r/ to the right edge of the stem.

This constraint requires that the affixal element be located as right as possible. It will penalize any dislocation of the element other than the right edge location. Hence a star is assigned for each element that is present to the right of the affixed element. A case of no violation is, of course, that the diminutive lies at the coda position of the final syllable. However, as we will see below in this section, the incorporation of the diminutive /r/ into the target syllable creates different degrees of violation of this constraint when it is ranked at different positions in the constraint hierarchy.

With the above constraints, we are now ready to examine how the different rankings among these constraints produce the variety of affixation phenomena in four Mandarin dialects. Let us start with the canonical r-suffixation in Beijing first.

3.2 Beijing

Beijing represents the majority of dialects in the Mandarin family. There have been a considerable amount of literature on the r-suffixation phenomenon in Beijing, both phonological and phonetic. In this paper, we will be concerned with the location of the diminutive morpheme only. It should be noted, however, that there are two major interpretations of its specific phonetic realization. One view holds that it is realized as a fully articulated retroflex (e.g., Jia 1992). The other holds that it is part of the vowel feature, i.e., the vowel is retroflexed (e.g., Lin and Yan 1988). Whatever the exact phonetic details, it suffices for us to note that phonologically speaking, the affix is located

along the rightmost edge of a stem. In this paper, we will follow Jia's version of the diminutive suffix treating it as a full fledged retroflex.

As we have seen in (1), the diminutive morpheme /r/ in Beijing surfaces as a phonological suffix in the output. Take the input stem /ma/ (horse) for example. There are three possible positions for the /r/ to appear in the output. It could land at the onset position replacing the input onset /m/ resulting in /ra/; it could occur between the input onset /m/ and the rime /a/ forming part of the complex onset in /mra/; or it could be realized as a coda as in the form /mar/. The attested form is the last possibility. Apart from this, note also that all the input element are realized in the output. It is apparent that this suffixal realization of the diminutive morpheme is purely morphological in Beijing in the sense that whatever the input, the morpheme always occurs at the right-most edge of the output. These observations suggest that both the constraint ALIGN (15) and PARSE (7a) are undominated in the constraint hierarchy. In contrast, the other three constraints, namely, *CODA, *COMPLEX and *HEAVY, are unmarked in the grammar. The following tableau demonstrates the evaluation of the input /ma/ with the constraint hierarchy PARSE, ALIGN >> *CODA:

(16) Input: {ma, r} *horse*
Tableau 1

Candidates	PARSE	ALIGN	*CODA
a. <m>ra	*!	a	
☞ b. mar			*
c. mra		a!	

In Tableau 1, (16b) is the optimal output even though it violates the constraint *CODA. The other two possible candidates contain more serious violations of higher constraints and thus failed to be selected. Specifically, (16a) contains an unparsed segment /m/ which violates the crucial PARSE condition. (16c) finds the retroflex located at the onset position forming part of the complex onset and hence constituting a fatal violation of the constraint ALIGN.

Note that in the above example, the input stem /ma/ is an open syllable which contains only the vowel [a]. In the case of closed syllables with extra material at the coda position, the same constraint hierarchy is also capable of accounting for the r-suffixation in Beijing. (17) illustrates the relevant evaluation for the input /tou/ (pocket) where the syllable final /u/ is to be interpreted as the glide /w/:

(17) Input: {tou, r} *pocket*
Tableau 2

Candidates	PARSE	ALIGN	*CODA	*COMPLEX	*HEAVY
a. to<u>r	*!		*		
b. trou		ou!	*	*	*
c. toru		u!	**	*	*
☞ d. tour			**	*	*

Hence it can be said here that the typical r-suffixation in Beijing is purely morphological, a case of morphological constraints such as ALIGN remaining undominated in the constraint hierarchy.

3.3 Anxiang

Anxiang is a Mandarin dialect spoken in Hunan Province, central China. The dialect [illegible] several studies on the diminutive formation

in Anxiang (e.g., Yip 1992 and Da 1995). In this section, we offer a revised account of its diminutive formation based on the analysis of Da (1995).

As we can see in (2), Anxiang has a similar diminutive formation process as in Beijing. All the input elements are realized in the output. However, the two dialects differ in that Anxiang further requires that the monosyllabic morpheme be (partially) reduplicated so that the diminutive morpheme can be inserted into the derived second syllable. For example, the input stem /p'au/ (bulb) is partially reduplicated resulting in /p'au.p'ər/ whose second syllable houses both the diminutive morpheme /r/ and the neutral vowel [ə]. If the same constraint hierarchy as in Beijing were adopted, we would get a hypothetical /paur/, though this is not what has been observed. There are two things we need to account for in terms of monosyllabic input. First, why the input has to be reduplicated. Secondly, why a neutral vowel is inserted rather than the reduplication of the input vowel.

A possible answer to these two closely related questions is that the dialect opposes the formation of either complex onset or complex coda. That is, the variation from the canonical variety of r-suffixation in Beijing is that the constraint *COMPLEX in the dialect emerges from its unmarked position in the constraint hierarchy and dominates ALIGN. (18) demonstrates the relevant evaluation:

(18) Input: { p'aur, r} *bulb*

Tableau 3

Candidates	PARSE	*COMPLEX	ALIGN	*CODA
a. p'a<u>r	*!			*
b. p'aur		*!		**
c. p'rau		*!	au	*
☞ d. p'au.p'ər				**
e. p'au.p'aur		*!		
f. p'ər.p'au			pau!	**

In Tableau 3, we find that (18d) is the most optimal output candidate. In comparison, (18a) fails to be selected because of its crucial violation of PARSE. The other two monosyllable candidates, (18b) and (18c), violate the constraint *COMPLEX either at the onset or coda position and hence is less optimal. So is the case of the disyllabic candidate (18e). (18f). in which the segmental /r/ surfaces at the first syllable, violates the constraint ALIGN and thus is less optimal as well.

However, this analysis is unable to account for cases such as /ke/ (square) whose corresponding diminutive is /ke.kər/. Under the present constraint hierarchy, two other optimal outputs, i.e., /ker/ and /ke.ker/,will be selected, since they are the most faithful and do not constitute a violation of the constraint *COMPLEX. Further, the above constraint hierarchy fails to provide the motivation for the inserted neutral [ə] in the output. It is obvious that an additional constraint needs to be called for to resolve this competition.

Remember that in Section 3.1, we mentioned that there is a limit to the weight of a syllable in Mandarin Chinese. In the case of the input /ke/ (whose rime /e/ is argued as being associated with two moras), the insertion of /r/ at the coda position would add an extra mora and create a super heavy syllable with three moras. Presumably, this is a situation which is to be avoided in Anxiang. It is only natural that a neutral vowel which is associated with one mora is inserted instead into the second syllable. In terms of constraints in OT, this fact suggests that the constraint *HEAVY is at work. In the constraint hierarchy, it emerges from an unmarked position and becomes dominant of the constraint

ALIGN. The following tableau provides a sample evaluation with the revised constraint hierarchy: PARSE, *HEAVY, *COMPLEX >> ALIGN >> CODA (19):

(19) Input: {ke,r} *square*

Tableau 4

Candidates	PARSE	*HEAVY	*COMPLEX	ALIGN	*CODA
a. σ (μ μ) k r e			*!	e	
b. σ (μ μ μ) k e r		*!	*		*
c. σ (μ μ) k ə r; σ (μ μ) k e				ke!	*
☞ d. σ (μ μ) k e; σ (μ μ) k ə r					*
e. σ (μ μ) k e; σ (μ μ μ) k e r		*!	*		*

In the above tableau, we find that (19d) is the most optimal output even though it contains the inserted suffix as a coda in the derived second syllable. In contrast, (19a) violates the crucial *COMPLEX constraint and fails to be selected. Both the monosyllable (19b) and disyllabic (19e) contains a super heavy syllable which violate the higher constraint *HEAVY. (19c), which contains the same 'ideal' syllable, loses the competition simply because of the location of /r/ in the first rather than the second syllable, a violation of ALIGN.

It should be noted that the present hierarchy is still unsatisfactory in that it will fail to accommodate for cases of disyllabic input, in which the rime of the second syllable is replaced with the neutral vowel rather than the creation of a new syllable. However, due to space limitations, we will not provide an account of that. It suffices for us to note here that the present constraint hierarchy is capable of accounting for the location of the diminutive /r/ in the dialect. In an alternative account, Da (1995) argues for the presence of a further

constraint on the prosodic minimal word in the Anxiang. Please refer to the relevant literature for more details.

3.4 Pingding

Pingding is a Mandarin dialect spoken in Sanxi Province, northern China. It has been described and studied by Xu (1981) and Wang (1994). The particular way of its diminutive morpheme formation presents an interesting case of affixation in Chinese prosodic morphology. Past derivational studies such as Wang (1994) are unsatisfactory in that they fail to see its link to the canonical r-suffixation in Beijing.

As we have seen in (3), unlike the r-suffixation in Beijing or Anxiang, the diminutive morpheme in Pingding is realized as an infixal retroflex lateral forming part of a complex onset. Apart from the complication in vowel variations, there are two things that are interesting for the issues addressed in this paper. First, why does the affix appear at the onset rather than the coda position. Secondly, how is it realized as a retroflex lateral rather than a coronal retroflex. Early study by Xu (1981) speculates that it is somehow related to the canonical suffixation in Beijing, though the exact mechanism is unavailable in his account.

Our answer to the first question is as follows. As we mentioned briefly in Section 3.1, Mandarin is undergoing a syllable simplification process, moving towards an unmarked CV template. the way that the diminutive affix is realized as an infix indicates that the syllable simplification process takes a different outlook in Pingding. That is, since the dialect is losing inherited codas, it is more likely that any added materials are to be located elsewhere rather than the coda position. To express such a tendency in terms of OT, we can say that it is a case when the unmarked *CODA emerges from a lower position in the constraint hierarchy and dominates the constraint ALIGN. Tableau 5 demonstrates the relevant evaluation with respect to the ranking: PARSE, *CODA >> ALIGN >> COMPLEX.

(20) Input: {suts'ʌ, r} *pocket*

Tableau 5

Candidates	PARSE	*CODA	ALIGN	*COMPLEX
a. su⌊.ts'ʌ		*!	ts'ʌ	
b. su.ts'ʌ⌊		*!		
c. su.⌊ts'ʌ			ts'ʌ!	*
☞ d. su.ts'⌊ʌ			ʌ	*
e. su.<ts'>⌊ʌ	*!		ʌ	

In Tableau 5, we find that (20d) emerges as the optimal candidate, though the affixal element is away from the ideal rightmost edge of the stem and violates the *COMPLEX constraint as well. In comparison, the landing of /r/ at the coda position in either the first syllable of (20a) or second syllable of (20b) violate the crucial *CODA constraint and thus failed to be selected. (20c) differs from the optimal (20d) in that the /r/ appears to the left edge of the second onset rather than to its right and hence constitutes a worse violation of the ALIGN constraint. (20e) loses the competition simply because it contains an unparsed element and hence a fatal violation of the undominated constraint PARSE.

Now let us address briefly the second question, i.e., why the affix is realized as a retroflex lateral. The possible explanation is a perceptual account according to which the segment is more likely to be understood as a lateral rather than retroflex at the onset

position (Xu 1981). However, for lack of relevant empirical evidence, we will leave the question open for future research. It is sufficient for us to show here that the locus of the diminutive morpheme is accountable in terms of the particular constraint hierarchy we have proposed above.

3.5 Jianou

Jianou is a dialect spoken in Fujian Province of southern China with a historical link to mainstream Mandarin Chinese. The dialect is described by Pan (1994). The l-infixation phenomenon is also attested in several other Mandarin dialects such as Taiyuan (Zhao 1979) and Yikol (Li 1991). In the literature of Chinese linguistics, l-infixation was first studied by Xu (1981). Later works include Wang (1994) and Da (1994). This section examines the relatively wide-spread phenomenon from the broad perspective of diminutive formation in Mandarin dialects.

To examine the l-infixation phenomenon in Jianou (4) more closely, two observations are at hand. Take the input stem /pu/ as an example. We find that the /l/ infix occurs as the only onset segment in the derived second syllable in the output /pu.lu/. Secondly, the rime of the derived syllable resembles that of the input. That is, there is a correspondence between the two /u/'s in the output.

There are two questions concerning the location and the shape of the affix in Jianou. First, is it different from the diminutive morpheme as in Beijing and Pingding? Secondly, if they are of the same origin, how is the retroflex realized as a plain lateral?

In the literature, answers to the first question fall into two different schools. One approach, as represented as Xu (1981), considers the two processes as originating from the same historical source. The other insight (Wang 1994) differs from Xu's account in that it insists that the two processes involve different derivational operations and should be treated separately. However, Wang's major counter arguments are based on observations of their superficial differences and hence do not form valid arguments.

In this paper, we follow the intuition of Xu (1981) which holds that the plain lateral infix such as in Jianou has its origin in the diminutive retroflex. Following this intuition, we propose that at the onset position, the retroflex is turned into a plain lateral. Evidence in support of this view comes from three possible sources. First, in terms of distribution, the lateral /l/ is the most sonorant (consonantal) segment in Mandarin which enjoys a much wider distribution than the retroflex /r/. Note that the /r/ at the onset position is limited to co-occur with a few vowels. In New Shanghai (a dialect of Wu family speaking in southeast China), for example, no retroflex is found. Secondly, it is the most natural sound used in onomatopoeia words in many languages of the world such as English, Chinese. Finally, both [r] and [l] are highly confusing in perception, especially for Mandarin speakers. A good example of this comes from the learning of English by Mandarin speakers. It is sometimes observed that they often confuse /r/ for /l/ in such English words as /frænk/ vs. /flænk/. For lack of empirical evidence, we will refrain from the formulation of specific constraints for the featural deviation from the input [r] to the output [l]. Instead, we will be concerned with the location of the l-infix.

To account for the location of the l-infix in Jianou, we have the following two observations. First, the affix locates at the onset of the second derived syllable rather than the coda position. This posits that the constraint *CODA emerges from its unmarked position and dominates ALIGN. Secondly, the l-infix is the only segment at the onset position. This must be the case that the dialect dislikes a complex onset. A proper formulation of this observation is to say that the constraint *COMPLEX is also marked in

the dialect and dominates ALIGN. Tableau 6 demonstrates the relevant evaluation in terms of the constraint hierarchy: PARSE, *COMPLEX, *CODA >> ALIGN.

(21) Input: {pu, r} *roll*
Tableau 6

Candidates	PARSE	*COMPLEX	*CODA	ALIGN
a. <p>lu	*!			u
b. plu		*!		u
c. pul			*!	
d. lu.pu				upu!
☞ e. pu.lu				u

In Tableau 6, we find that (21e) comes out as the most harmonious output candidate. In comparison, (21a) contains an unparsed element and violates the crucial constraint PARSE. (21b) has a complex onset and loses the battle as well. (21c) is left out of the competition because of its fatal violation of the constraint *CODA. (20d) finds the l-infix located too far from the rightmost edge of the output and constitute a worse violation of the constraint ALIGN.

4. Concluding remarks

In this paper, we have examined the diminutive formation process in four Mandarin dialects. The central claim of this paper is that despite its disguised forms in various dialects, we have argued that the locus (as well as the shape) of the diminutive morpheme is the result of interaction between the constraint ALIGN and other constraints such as the well-formedness conditions on syllable structures in Mandarin Chinese. In particular, we have shown that when the ALIGN is undominated by other constraints, we have observed the canonical r-suffixation in Beijing. With the presence of phonological constraints such as *HEAVY and *COMPLEX in Anxiang, other phonological variations such as reduplication will occur in addition to straight forward r-suffixation. Further, we have shown that the dominating ranking of *COMPLEX and *CODA is responsible for the two distinct infixation phenomena in Pingding and Jianou. This Optimality-theoretic analysis has two implications. Theoretically speaking, it provides further empirical supports to the insights of the Generalized Alignment Theory. We have seen that the variation of rankings between GA and other constraints can account for the systematic variations of affixation. Language specifically, it allows us for the first time to provide a united account of the whole range of affixation phenomena in Mandarin dialects. Future research is needed to address those empirical issues left open in this paper.

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